## Invertebrates Found in Water Hyacinth Mats

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The water hyacinth, *Eichornia crassipes* (Mart.), is a perennial, floating, mat-forming aquatic plant which is known to be established in most of the southern states. In many areas where it flourishes, it produces mats that cover thousands of acres of fresh water and often develops so thickly as to impede navigation. The plant has an extensive root system that often reaches a length of three feet. This gives the hyacinth mat an interface area that is greater than any other floating aquatic plant. Thus, the presence of water hyacinths creates a vast new habitat for colonization by aquatic invertebrates in areas of open water that would normally be dominated by larger predaceous forms.

A number of studies have shown that direct relationships exist between aquatic plants and many species of aquatic invertebrates. Krecker (1939) and Rosine (1955) demonstrated a relationship between invertebrate populations and the surface area of submerged aquatic plants. Scotland (1934) investigated the species of animals associated with a floating plant. There have been no studies done on the relationship between aquatic invertebrates and water hyacinths.

Goin (1943) studied the lower vertebrate fauna associated with water hyacinths, and Dickinson (1949) had occasion to investigate hyacinth infested ponds in a study of the biota of ponds and ditches. However, he gave no information regarding the animals associated specifically with hyacinths.

In view of the lack of information concerning this plant-animal relationship, this study was designed to survey the invertebrate animals that are associated with the hyacinth root mat and obtain an indication of their relative abundance. I would like to thank Dr. B. P. Hunt, Dr. D. R. Paulson, and Dr. E. R. Rich for their continuing help and guidance throughout this project. I would also like to thank Dr. F. G. Butcher, Dr. J. P. Moore, Dr. H. van der Schalie, and Dr. J. E. Wilson for identifying several of the specimens collected.

This study is based on 11 collections made between December, 1959, and May, 1960, south of Lake Okeechobee, Florida (see Appendix). Collections were generally made in slow flowing

canals up to one and one-half meters deep. All collections were made in water deep enough to allow the collecting net to pass beneath the roots without disturbing them. The use of the net is similar to that described by Goin (1942). The sampling differed from Goin's by having a smaller mesh screening (30 meshes-to-the-inch) in the net. One portion of the net was isolated as a center well with a known area and all quantitative measurements were based on the organisms collected in this center well. The animals and hyacinths were placed in a large plastic bag, preserved in 10 percent formalin, and taken to the laboratory. The animals were then washed free of the root mass, identified and counted. Details of these procedures are given by O'Hara (1961).

The invertebrate fauna associated with water hyacinths is generally typical of bottom fauna communities. The invertebrates collected totaled over 44,000 specimens comprising over 55 species. The total list of species is not complete since not every animal was fully identified.

The most abundant invertebrate forms collected were the Gastropoda with a total of 2,098 specimens in 11 collections. This total consisted of about six species and comprised an average of 28 percent of the animals collected (Table I).

TABLE 1.

Invertebrate populations found in hyacinths

| Collection | Animals/m² | Gastropoda | *Hyallela azteca* | Insect larvae | Other animals |
|---|---|---|---|---|---|
| 1 | 3,446 | 62% | 3% | 2% | 33% |
| 2 | 7,242 | 40 | 21 | 18 | 21 |
| 3 | 9,573 | 60 | 1 | 10 | 29 |
| 4 | 8,650 | 2 | 61 | 9 | 28 |
| 5 | 7,626 | 2 | 70 | 5 | 23 |
| 6 | 6,505 | 7 | 72 | 3 | 18 |
| 7 | 7,357 | 33 | 37 | 8 | 22 |
| 8 | 10,370 | 36 | 0 | 54 | 10 |
| 9 | 11,864 | 49 | 5 | 28 | 18 |
| 10 | 24,573 | 18 | 2 | 35 | 45 |
| 11 | 84,223 | 0 | 95 | 0 | 5 |
| Average | 16,484 | 28% | 33% | 15% | 23% |

*Hyallela azteca* was the most common single species with a total of 1,622 specimens obtained in collections 1 through 10. Collection 11 contained a total of 81,430 *H. azteca* per square meter. This exceedingly dense population occurred in a permanent lake situation as opposed to the slow flowing canal environment of the other collections. An average of 33 percent of the animals collected belonged to this species, although this figure is heavily weighted by the large population in collection 11.

The total number of insect larvae collected was 1,242 for 11 collections. This total was composed of about 33 species and comprised an average of 15 percent of the total animals collected.

Other animal groups comprised a very small percentage of the total animal numbers. In collection 10 Oligochaeta comprised 41 percent of the total number of animals. This high percentage can be correlated with strong evidence of agricultural pollution at this location. The worms (*Tubifex* sp.) were almost totally absent at this same location one week before collection 10 was made.

The following is a list of the invertebrates collected in water hyacinths, with notes on their frequency of occurrence.

## Class Turbellaria

Planarians were found in all collections in small numbers. These forms apparently become abundant in localized situations with the greatest concentration found being over 1,000 per square meter in collection 1.

## Class Oligochaeta

*Tubifex* sp. were noted to be in abundance only in collection 10. These forms are often considered to be indicators of organic pollution, which agrees with the water condition at the site of collection 10. Three unidentified species of Oligochaeta were also found to live in hyacinths.

## Class Hirudinea

*Dina lateralis* was the most common leech found to live in association with water hyacinths. *Macrobdella ditetra, Helobdella triserialis,* and *Placobdella parasitica* were also collected. Hirudoids were represented in all collections except 1 and 4 but seldom in large numbers.

### Class Gastropoda

*Physa pomilia* was the most frequently observed form in all collections except collections 1, 3, and 11. *Helisoma trivolvis* was the most common species found in collections 1 and 3. Collection 11 contained no Gastropoda. *Pomacea miamiensis* was represented occasionally as was *Pseudosuccinea columella. Amnicola sactijohannis* and *Gyraulus parvus* was relatively rare.

### Class Pelecypoda

*Sphaerium partumeium* and *Sphaerium securis* occurred only in collections 3 and 5 and not in large numbers.

### Class Arachnida

*Arrenurus birgei, Arrenurus major, Arrenurus spetiolatus, Arrenurus magnicaudatus,* and *Arrenurus falcicornis* were found to occur in water hyacinths but generally in very small numbers. One form or another was found in all collections. *A birgei* appeared to be the most common form. One unidentified hydracarina was also collected.

### Class Crustacea

*Hyallela azteca* was represented in all collections except collection 8. The relative abundance of this form is discussed earlier. *Palaemonetes paludosa* occurred in collections 3, 4, 5, 6, 7, 9, and 11 but rarely in very large numbers. *Procambarus alleni* was taken in collections 2, 3, 5, and 6, but no more than one specimen was taken in each.

### Class Insecta (Ephemeroptera)

Berner (1950) indicated that *Caenis diminuta* is rarely found in association with water hyacinths because of lack of oxygen. In collection 3, 4, 6, 7, and 8, this species and *Callibaetis floridanus* were very common. Collection 8 had a population of 1,652 Ephemeroptera per square meter, of which the greatest number were *C. diminuta.*

### Class Insecta (Odonata, Anisoptera)

Of the twenty-nine Odonata nymphs collected, eighteen were *Erythemis simplicicollis. Cannacria gravida, Miathyria marcella, Pachydiplax longipennis,* and *Tetragoneuria* sp. were represented in the collections. Anisoptera nymphs were taken in all collections except collections 6, 7, 10, and 11.

### Class Insecta (Odonata, Zygoptera)

*Ischnura ramburii* and *Enallagma* sp. were identified as occurring in water hyacinths but were never present in large numbers.

### Class Insecta (Diptera)

Because of difficulty in obtaining exact taxonomic determinations, insect larvae and pupae other than Ephemeroptera and Odonata were largely identified only to family groupings. Insect larvae were found in all collections except collection 11. Although the representation in each collection was frequently very different, the total relative abundance is presented here as a composite view of the insects found in association with water hyacinths.

Chironomidae were by far the most abundant insect larvae found in the hyacinth community. This group appeared to contain several species in both larval and pupal stages, although the exact number of species was not determined.

Ceratopogonidae were fairly abundant and only two species were distinguished. Both larvae and pupae were collected.

Stratiomyidae larvae were taken only in collection 10 but they were fairly abundant in this location.

Several unidentified Diptera larvae were also collected.

### Class Insecta (Coleoptera)

Hydrophilidae and Dytiscidae adults were rare and no larvae were taken.

Omophronidae adults were very common, being found in over half the collections. Haliplidae adults were quite abundant in localized situations. *Haliplus* was the only genus noted.

Gyrinidae was represented only by the larval stage and never

in great abundance, although the adults were commonly observed in nearby open water. *Gyrinus* was the only genus noted.

### Class Insecta (Trichoptera)

No identification was made on these forms. There are at least three species present in the hyacinth environment, as determined by the types of cases found, although all are relatively rare.

### Class Insecta (Hemiptera)

Nepidae were uncommon in water hyacinths. *Ranatra* sp. was collected only twice.

Naucoridae were common in localized situations and all stages of development of *Pelocoris* sp. were taken.

Belostomatidae were infrequent in most collections but occasionally nymphs were observed in large numbers. This was probably due to a hatching of an egg mass. All stages of development of *Belosoma* sp. were taken.

## Conclusion

The total number of organisms per square meter shows an extreme variation from 3,446 to 84,223 per square meter with an average of 16,484. Attempts to relate invertebrate population size to size of the root mass were unsuccessful. The animal populations are considerably larger than are generally found in bottom samples and in other plant associations. Ball (1948) reported 2,641 bottom organisms per square meter and 175 organisms per pound wet weight of *Potamogeton* in Third Sister Lake in Michigan. This compares with a calculated minimum of 902 organisms per pound wet weight of hyacinth roots. Cooper (1941) found the average number of organisms in 44 Maine lakes to be about 1,600 organisms per square meter of lake bottom. Unpublished data of the author show an average of 2,449 organisms per square meter of lake bottom in three Florida lakes.

It is quite evident that the animal populations in water hyacinths are usually far larger than the populations obtained from other aquatic habitats. One major factor contributing to a larger population is the three dimensionality of the hyacinth environment compared to the relatively thin bottom environment.

## Appendix

All collections except number 11 were obtained in the canals located alongside the highways indicated.

Collection 1. December 23, 1959. Dade County. 0.5 miles south of 224th Street on 87th Avenue near Perrine, Florida.

Collection 2. January 15, 1960. Broward County. 1.7 miles south of Florida Highway 810 on Lyons Road near Margate, Florida.

Collection 3. February 27, 1960. Collier County. 10.4 miles west of Collier-Dade County line, on U. S. Highway 41.

Collection 4. March 11, 1960. Glades County. 3.8 miles north of U. S. 27 on Florida Highway 78.

Collection 5. March 11, 1960. Glades County. 8.2 miles north of U. S. 27 on Florida Highway 78.

Collection 6. April 29, 1960. Broward County. 6.0 miles north of Andytown on U. S. Highway 27.

Collection 7. April 29, 1960. Hendry County. 0.6 miles east of Florida Highway 80 and U. S. Highway 27.

Collection 8. April 29, 1960. Collier County. 36.4 miles north of Carnestown on Florida Highway 29.

Collection 9. April 29, 1960. Collier County. 6.4 miles east of Monroe Station on U. S. Highway 41.

Collection 10. May 6, 1960. Collier County. 36.4 miles north of Carnestown on Florida Highway 29.

Collection 11. May 6, 1960. Collier County. Peppers Cove on Lake Trafford.

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